Synopsis of Vital Signs Monitors and the 2014 Capnography Requirement

Conscious sedation is an important aspect in the delivery of federal service dental care. Although the scope of care varies by facility, many dental care facilities offer conscious sedation/anxiolysis as an adjunct in providing oral surgical, periodontal, pediatric, and hospital dental care. The American Association of Oral and Maxillofacial Surgeons (AAOMS) Parameters of Care and AFI 47-101 are guidance sources concerning local anesthesia, conscious sedation (including nitrous oxide) and deep sedation/general anesthesia.

Recently, an additional requirement was placed on vital signs monitoring of sedated patients. This new requirement, suggested by the American Association of Oral and Maxillofacial Surgeons (AAOMS), requires the monitoring of end tidal carbon dioxide ($etCO_2$) and is to be implemented by January 2014. The following paragraph is an excerpt from **AAOMS ParCare 2012, Anesthesia in Outpatient Facilities:**

"The use of capnography for patients under moderate sedation, deep sedation and general anesthesia should be instituted in OMS practice and used on these patients effective January 2014 unless precluded or invalidated by the nature of the patient, procedure, or equipment. It is anticipated that this implementation date will allow adequate time for the refinement of materials and methods so as to optimize the use of capnography in an open system."

The American Society of Anesthesiologists amended their standards for basic anesthetic monitoring on 20 October 2010 and uses the term "shall be instituted" rather than "should be instituted". To assist you in comprehending the scope of this change in monitoring, the following definitions have been included in this synopsis. These definitions have been provided by the **American Society of Anesthesiologists (ASA) Continuum of Depth of Sedation Definition of General Anesthesia and Levels of Sedation/Analgesia (approved by the ASA House of Delegates on October 27, 2004, and amended on October 21, 2009 and again on October 20, 2010).**

Definition of Moderate Sedation/Analgesia: a drug induced depression of consciousness during which patients respond purposefully to verbal commands, either alone or accompanied by light tactile stimulation. No interventions are required to maintain a patent airway, and spontaneous ventilation is adequate. Cardiovascular function is usually maintained.

Definition of Minimal Sedation (Anxiolysis): a drug-induced state during which patients respond normally to verbal commands. Although cognitive function and physical coordination may be impaired, airway reflexes and ventilator and cardiovascular functions are unaffected.

Monitoring: Continuous, time-sensitive monitoring is required. Equipment must include:

> **Blood pressure monitor** with an automated time determined capability and a method for recording the data.
> **ECG monitor** to visualize the cardiac rhythms is required for interpretation.
> **Pulse oximetry** must be used to follow the oxygen saturation in the blood throughout the procedure as a measure against the baseline value. Monitors with print and/or storage capability are available.
> **Capnography** should be considered in all anesthetics. During moderate or deep sedation and general anesthesia the adequacy of ventilation shall be evaluated by continual observation of qualitative clinical signs and monitoring for the presence of exhaled carbon dioxide unless precluded or invalidated by the nature of the patient, procedure or equipment. Beginning in 2014, AAOMS Office Anesthesia Evaluations will require capnography for moderate sedation, deep sedation and general anesthesia. Temperature will be monitored if indicated. Consideration should be given to a precordial stethoscope during anesthesia administration to listen to breath sounds and cardiac rhythm. Monitoring equipment should be checked and calibrated in accordance with the manufacturer's recommendations

When considering a vital signs monitor for a facility, many features deserve consideration: cost, convenience, upgrade capability, and the ability of the unit to produce a written record of vital signs. For most facilities providing conscious sedation, equipment that measures blood pressure, ECG, pulse, pulse oximetry, and end tidal carbon dioxide (capnography) will satisfy the minimum required monitoring. For

clinics that have recently purchased vital signs monitors that do not have the capability to measure end tidal carbon dioxide, upgrades or add-ons are available from the manufacturer that will allow you to measure end tidal carbon dioxide. Often, these add-ons are nearly as expensive as purchasing a new monitor.

DECS gathered information from 25 clinics to see what they are currently using. We found that many oral surgeons preferred Criticare Systems (nGenuity) for its comprehensive display and printout. Some other clinics preferred the Mindray (Passport V) monitor because it was simpler to use. The Welch Allyn (Propaq CS) was the most commonly used monitor. Below is a list of bases (not all-inclusive) that responded to our request for information. The bases are grouped by the vital signs monitor(s) that they are using. Some bases purchased vital signs monitors from more than one manufacturer.

Lackland OMFS:	Criticare nGenuity 8100
Keesler:	Criticare nGenuity 8100
Offutt:	Criticare nGenuity 8100EP
Moody	Criticare nGenuity 8100
Little Rock	Criticare nCompass
Hickam	Criticare nGenuity 8100
Lackland Periodontics:	Mindray Passport V
Barksdale:	Mindray Datascope Spectrum (FYI Passport V has replaced the Datascope Spectrum)
Sheppard:	Mindray Datascope Passport2
Scott:	Mindray Passport V
Elmendorf:	Mindray Datascope Passport 2 (also uses Propaq Encore)
WPAFB:	Mindray Datascope DPM5 (also uses Propaq CS by Welch Allyn)
Travis OMFS:	Welch Allyn Propaq CS
Travis (clinic):	Welch Allyn Propaq CS
Okinawa:	Welch Allyn 300 series
Ramstein:	Welch Allyn 300 series
Lakenheath:	Welch Allyn Encore
WPAFB:	Welch Allyn Propaq CS (also uses Mindray Datascope DPM5)
Air Force Academy:	Welch Allyn Propaq CS
Misawa	Welch Allyn Propaq CS
Bolling	Welch Allyn Propaq CS
Yokota	Welch Allyn Propaq CS
Elmendorf:	Welch Allyn Propaq Encore (also uses Mindray Datascope Passport 2)
SAMMC OMFS:	Infinity Delta by Drager
Andrews:	Phillips Televiewe MP70 (CO_2 accessories have already been ordered for unit)
Eglin:	Dinamap 1000 GE
Nellis:	CAS 740 by CAS Medical Systems and Invivo

Click Here for a list of available Capnography Monitors

Source	CRITICARE SYSTEMS, INC. 20925 Crossroads Circle Waukesha, Wisconsin 53186 (800) 458-4615 http://www.csiusa.com	
Model:	nGenuity™ w/CO_2 (8100EP1) 	nCompass™ w/CO_2 (81H001P) 
Specifications:		
Pulse Oximeter (SPO_2), Blood Pressure (BP), Heart Rate, Temperature, Respiration Rate, Electrocardiograph (ECG), Alarms	Yes 3 or 5 leads	Yes 3 or 5 leads
Capnography ($etCO_2$)	Sidestream	Sidestream
$etCO_2$ Add-on capabilities to existing unit	Yes Approximate upgrade kit price may vary from $3,000.00 - $4,000.00 based on existing unit and warranty.	Yes Approximate upgrade kit price may vary from $3,000.00 - $4,000.00 based on existing unit and warranty.
Monitor (Size/Type)	10.4”/LCD w/TFT	12.1”/LCD
Dual Power	Yes	Yes
Battery	Yes	Yes
Battery Use Life	2.5 hours	2-3 hours
Size: Height x Width x Depth (inches)	11 x 13 x 10.3	12 x 14.5 x 11.5
Weight (pounds)	14 lbs	12 lbs
Warranty	2 years	2 years
Cost: Price varies with options selected please contact your local distributor/manufacturer for exact prices.		
Government	$4,995.00	$5,255.00
Suggested Retail	$6,600.00	$7,505.00

CRT-Cathode Ray Tube ELD Electroluminiescent Display LCD- Liquid Crystal Display LED Light Emitting Diode TFT-Thin-Film Transistor NIBP Noninvasive Blood Pressure
$etCO_2$-End Tidal $INCO_2$-inspired CO_2

Mainstream capnography- uses an in-line infrared CO2 sensor connected directly to the airway, between the endotracheal tube and the breathing circuit.

Sidestream capnography- airway gas samples are collected from the breathing circuit; the infrared sensor is located in a remote monitor.

Microstream technology- accurately measures alveolar CO2 in newborns without pulmonary disease, as demonstrated
by normal PetCO2 -PaCO2 gradients

Source	Mindray North America DS USA, Inc 800 MacArthur Blvd Mahwah, NJ 07430-0619 (800) 288-2121 (press 3) www.mindray.com	Welch Allyn Inc. 4341 State Street Road Skaneateles Falls, NY 13153 (800) 535-6663 www.welchallyn.com
Model:	Mindray Passport V 	Propaq® CS Vital Signs Monitor Model 242 w/CO_2 
Specifications:		
Pulse Oximeter (SPO_2), Blood Pressure (BP), Heart Rate, Temperature, Respiration Rate, Electrocardiograph (ECG), Alarms	Yes 3 or 5 leads	Yes 3 or 5 leads
Capnography ($etCO_2$)	Sidestream or Microstream	Sidestream
$etCO_2$ Add-on capabilities to existing unit	Yes Approx upgrade kit price may vary from $4,000.00 - $5,133.00	Yes
Monitor (Size/Type)	12.1”/LCD	8.4”/LCD
Dual Power	Yes	Yes
Battery	Yes; Lithium Ion	Sealed, gel-type lead acid
Battery Use Life (hours)	2.5 plus hours (two batteries) 2 hours (one battery)	3 hours
Size: Height x Width x Depth (inches)	11 x 5.5 x 11.8	11.4 x 9.6 x 7.7 (w/printer/SpO_2/CO_2)
Weight (pounds)	11 lbs	14.4 lbs
Warranty	1 year	3 years
Cost: Price varies with options selected please contact your local distributor/manufacturer for exact prices.		
Government Price	$14,000.00	$6,207.75
Suggested Retail Price	$18,806.00	$6.975.00

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Source	Draeger Medical, Inc 3135 Quarry Road Teleford, PA 18969 (800) 437-2437 www.draeger.com
Model:	Infinity® Delta 
Pulse Oximeter (SPO_2), Blood Pressure (BP), Heart Rate, Temperature, Respiration Rate, Electrocardiograph (ECG), Alarms	Yes 3,5,6 or 12 leads
Capnography ($etCO_2$)	Mainstream Sidestream Microstream
$etCO_2$ Add-on capabilities existing unit	Yes - Prices may vary depending on the existing unit and warranty.
Respiration Rate	Yes
Monitor (Size/Type)	10.4”/LCD w/TFT
Dual Power	Yes
Battery	Lithium-ion
Battery Use Life (hours)	3 hours
Size: Height x Width x Depth (inches)	10 x 14.4 x 7.5
Weight (pounds)	14 lbs
Warranty	Contact company
Cost: Price varies with options selected please contact your local distributor/manufacturer for exact prices.	
Government Price	$16,700
Suggested Retail Price	Contact company for further details

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This is a synopsis of the most commonly used monitors in the federal services. This list is not all-inclusive and information was gathered from product representatives, by personal communication, or from the manufacturers' website.